Bloomington Geometry Workshop 2009
Titles and abstracts.

1 Christine Breiner, Conformal Structure of Minimal Surfaces with Finite Topology

We show that a complete, embedded minimal surface in $\mathbb{R}^3$ with finite topology and one end is conformal to a once-punctured compact Riemann surface. Using the conformality and embeddedness, we show the Weierstrass data is asymptotic to that of the helicoid. As a corollary, we see that the end is C^0 asymptotic to a helicoid.

2 David Fisher, Groups not acting on manifolds

Gromov has conjectured that a generic group should have no non-trivial actions on compact manifolds. I will survey current progress on this question. This is primarily based on joint work with Lior Silberman.

3 Daniel Groves, Parametrizing surface bundles

Let S be an orientable surface of finite type (not a torus or a sphere) and B a reasonable space (CW complex or manifold). Then the set of S-bundles over B is naturally parametrised by the set $Hom(\pi_1(B), Mod(S))/\sim$ of conjugacy classes of homomorphisms from the fundamental group of B to the mapping class group of S.

I will discuss work in progress which provides a structure theory for $Hom(G, Mod(S))/\sim$ whenever G is a finitely generated group.

4 Matthew Hedden, On the knot theory of algebraic curves

Given a complex surface one can intersect algebraic curves with a real codimension one hypersuface. In this way we obtain a natural geometric class of knots and links in three-manifolds. I will discuss what is known about this class and focus on some recent developments.

5 Boris Kalinin, Smooth rigidity of hyperbolic $\mathbb{Z}^k$ actions on tori and nilmanifolds.

It is conjectured that irreducible smooth hyperbolic actions of $\mathbb{Z}^k$ and $\mathbb{R}^k$, $k > 1$, on compact manifolds are smoothly conjugate to algebraic actions. For $\mathbb{Z}^k$ actions the algebraic models are actions by commuting affine automorphisms of tori or nilmanifolds. Any hyperbolic action of $\mathbb{Z}^k$ on a torus or nilmanifold is known to be topologically conjugate to such an algebraic action. So in this case the problem is to establish smoothness of the conjugacy. We will talk about results in this area and about the recent progress made for totally nonsymplectic actions in the joint work with D. Fisher and R. Spatzier.

6 Jean-Francois Lafont , Computing K-groups of infinite groups

The algebraic K-theory of integral group rings ZG form a family of functors which are particularly useful in (high-dimensional) topology. I will provide an overview of the general approach towards computing these invariants in the case where G is an infinite group. I will illustrate this approach by sketching out how one can obtain a combinatorial formula for the rationalized Whitehead group, in the special case where G is a Coxeter lattice acting on hyperbolic 3-space. This last result is joint work with Magurn and Ortiz.

7 Kasra Rafi, Counting closed geodesics in a stratum.

TBA. (Joint work Alex Eskin and Maryam Mirzakhani)

8 Sergei Tabachnikov, The mysterious Pentagram Map

Introduced by R. Schwartz 17 years ago, the pentagram map acts on n-gons, considered up to projective equivalence, by drawing the "short" diagonals connecting second-nearest vertices and taking the new n-gon formed by their intersections. Computer experiments show that the pentagram map has quasi-periodic properties usually associated with completely integrable systems. I shall demonstrate that the pentagram map has an invariant Poisson structure, sufficiently many integrals, and is completely integrable in the Arnold-Liouville sense. I shall also show that the pentagram map is a discretization of the Boussinesq equation, a well known completely integrable PDE. Based on a joint work with V. Ovsienko and R. Schwartz.